JHE JOURNAL OF HOME ECONOMICS, MENOUFIA UNIVERSITY
Website: https://mkas.journals.ekb.eg
Print ISSN 2735-5934 Online ISSN 2735-590X

NUTRITION AND FOOD SCIENCES

Antidiabetic Potential of juniper plants in diabetic rats.

Lobna Abd Elmeged, Nadiah Alzahrani

Department of Home Economics (Nutrition), Faculty of Science and Arts in Al-Makhwa, AL-Baha University, AlMakhwa, Saudi Arabia

Article Type
Original Article

Corresponding author:
Lobna Abd Elmeged
lobna@bu.edu.sa
Mobile: +966 53 302 6320

DOI:10.21608/mkas.2024.249892.1265

Cite as:
Lobna Abd Elmeged, and Nadiah Alzahrani. (2024). Antidiabetic Potential of juniper plants in diabetic rats. JHE, 34 (2), 1-17

Received: 19 Nov 2023
Accepted: 8 Jan 2024
Published: 1 Apr 2024

ABSTRACT:

Juniper is a coniferous plant classified within the cypress family. Traditionally, juniper has been used for its therapeutic qualities, specifically in treating specific health ailments, such as diabetes. This experiment aims to demonstrate the antidiabetic properties of juniper plants in rats with diabetes. A set of thirty (30) male albino rats of the Sprague-Dawley strain, each weighing 170±10g at ten weeks of age, were divided into four separate groups. The initial group functioned as a negative control, serving as the standard against which the other groups were compared. However, the other groups were exposed to alloxan induction in order to induce diabetes. During the 28-day duration of the trial, individuals in the positive control group with diabetes were administered juniper plants at concentrations of ten percent, twenty percent, and twenty-five percent. After the experiment, the removed organs and blood samples were subjected to biochemical analysis. A notable disparity was seen across the groups before and after the intervention concerning glucose levels (P = 0.005). Group 5, consisting of hyperglycemic rats fed a 25% juniper diet, had the highest blood glucose, HDL, AST, and creatinine levels. Based on these findings, juniper syrup is suggested for those with diabetes to lower LDL atherogenic index values. Additionally, different doses of juniper powder may be advised for specific health conditions related to diabetes

***Keywords**: Herbs, Phenolic compounds, Glucose, Hyperglycemia, Diet, lipids*

INTRODUCTION

Progress in clinical research and quality control has demonstrated that herbal medicine possesses a heightened capacity to treat and surmount numerous diseases. Recent research investigations have documented encouraging prospects concerning the application of plants for the prevention/or treatment of numerous incurable ailments, including atherosclerosis [1]. Junipers are coniferous shrubs and trees belonging to the Cupressaceae family of cypresses. Their genus is Juniperus. The distribution of junipers is extensive across the Northern Hemisphere, encompassing regions such as the Arctic, southern and tropical Africa, parts of western, central, and southern Asia, eastern and Tibet in the Old World, and mountains of Central

America, with an estimated fifty to sixty-seven species. The most towering tree line on the planet is found in the highest-known juniper forest in southeastern Tibet and the northern Himalayas, at an elevation of 4,900 meters (16,100 feet) [2]. Therapeutic applications are due to the abundance of bioactive components in Juniperus, which include phenolics, terpenoids, organic acids, alkaloids, and volatile compounds. These bioactive components, such as [specific compound names], have shown potential in the treatment of diseases such as diabetes, hyperlipidemia, and cancer, among others.

In recent years, abundant research has been conducted to explore the diverse applications of this evergreen shrub, yielding results that span numerous biomedical domains. The benefits above encompass antimicrobial activity against contaminated microorganisms and human pathogens, antioxidant and anti-inflammatory characteristics, implications for diabetes, hyperlipidemia, and neuroprotection, as well as cancer cell growth inhibition [3]. Due to the aforementioned potential advantages, bioactive compounds and extracts derived from the juniper tree may be helpful in the development of innovative pharmaceuticals intended for the treatment of various acute and chronic human diseases [4]. The study evaluated the antidiabetic and antihyperlipidemic properties of Juniperus communis (Cuppraseae), a coniferous plant frequently utilized in traditional medicine, in Streptozotocin (STZ)-nicotinamide-induced diabetic rodents. The diabetic group received oral administration of methanolic extract of Juniperus communis at concentrations of 100mg/kg and 200mg/kg (b.w.), except the control group, which received a 10mg/kg (b.w.) dose of Glibenclamide. Fasting blood glucose levels and various biochemical parameters were assessed on the 21st day following blood collection via the retroorbital puncture method. Diabetic rodents exhibited a notable (P below 0.01) decrease in plasma Glu levels and a rise in levels of HDL, among other lipid profile parameters, in response to the extract. The current investigation established the extract's dose-dependent and statistically significant antidiabetic and antihyperlipidemic effects, thereby substantiating its potential as a therapeutic intervention for diabetes of type 2 [5]. As previously stated, species of J. communis L. consist of an extensive variety of components involving phytochemicals, which are non-essential substances [6]. Plants generate these secondary metabolites to facilitate their cellular metabolism and provide defense against biotic and abiotic influences, thereby preventing oxidative damage [7]. In addition, they are widely acknowledged as the primary factors responsible for imparting health benefits and organoleptic qualities (such as color and aroma) to plants. Five primary classifications can be identified among

them (Figure 1). Levels are based on the plant's age, degree of maturation, cultivation methods, geographical location, meteorological conditions, and cultivation method, even though genotype is the primary determinant of quantitative and qualitative composition [8]

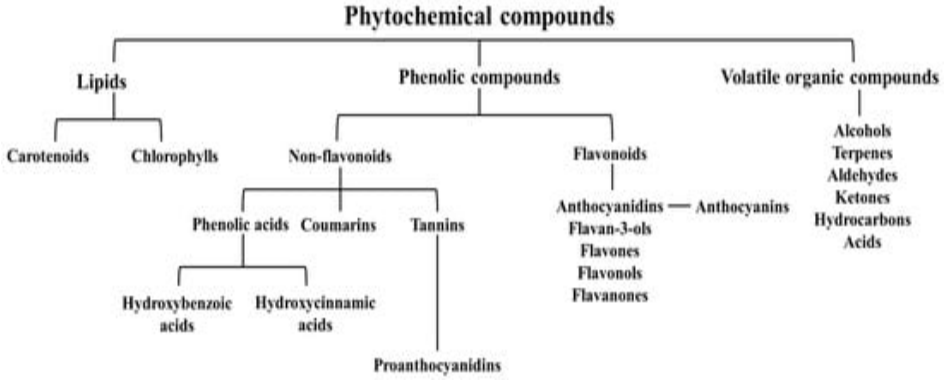

Figure 1. The primary phytochemicals isolated from Juniperus communis L. [9].

DM, a metabolic disorder characterized by impaired production or utilization of insulin, is a complex disease with various manifestations. The consequence of insulin deficiency or reduction is persistent hyperglycemia and Glu intolerance. It is likely the earliest disease that has been documented in human history, even earning the moniker of the "black death" since the 14th century [10]. Patients who have diabetes continue to have elevated blood sugar levels. This could result from insufficient or non-existent insulin production, inadequate insulin levels, or suboptimal insulin effectiveness. The disease is broadly categorized into diabetes of type 2 (ninety-five percent), which is linked to obesity, and diabetes of type one (five percent), immune system disease. There are also subtypes such as gestational diabetes, which manifests throughout pregnancy, and rarer variants of the disease attributed to single-gene mutations [11]. In this comprehensive context, the present study investigates the influence of juniper plants on improving blood sugar in hyperglycemia rodents.

MATERIALS AND METHODS

MATERIALS

Juniper plants were obtained from local markets in Jeddah, Kingdom of Saudi Arabia.

Alloxan: pure fine chemicals were purchased from sigma, Cairo, Egypt

Chemical kits: All chemical kits used in analysis were obtained from authorized companies in Saudi Arabia.

Rats:

Thirty male Sprague Dawley rats (n = 30) weighing 150±10 g was obtained from Egypt's Ministry of Health's Animal Unit at

Helwan Farm. For two weeks, the rats were kept in individual plastic cages under controlled environments, with a temperature of 22 °C and a 12-hour light/dark cycle.

Rats have unrestricted access to food and water. All experiments followed the National Institute of Health's Guiding Principles for Animal Care and Use. Rats were weighed after two weeks of acclimatization and randomly allocated to one of two groups: diabetic (24 rats) or normal (6 rats).

Diets:

The animals were fed a standardized diet that contained different amounts of juniper powder (Table 1-3). The experimental procedures adhered to the guidelines outlined in the National Institute of Health Guide for the Care and Use of Laboratory Animals.

Table (1): Composition of different diets (gram/100 gram)

Ingredients	Basal diet*	10% J	20% J	25% J
Protein (casein)	10	10	10	10
Corn oil	10	10	10	10
Mineral mixture	4	4	4	4
Vitamin mixture	1	1	1	1
Cellulose	5	5	5	5
Choline chloride	0.2	0.2	0.2	0.2
Methionine	0.3	0.3	0.3	0.3
Juniper powder	0.0	10.0	20.0	25.0
Corn starch	Up to 100	Up to 100	Up to 100	Up to 100

** Source : Reeves et al., [12].*

Preparation of juniper plants:

Juniper plant were purchased from the local market of Jeddah KSA, then plants were washing, and cut into small slice and dried in drying oven at temperature 50°C for 3 days, then crushed and milled as fine powder.

Table 2: The composition of salt mixture (g/100 g)

Ingredients	Amounts
CaCO3	600 mg
K2 HPO4	645 mg
Ca HPO4. 2H2O	150 mg
MgSO4.2H2O	204 mg
Naci	334 mg
Fe (C6H5O7) 26H2O	55 mg
Kl	1.6 mg
MnSO4.4H2O	10 mg
Zncl2	0.5 mg
Cu SO4. 5H2O	0.06 mg
CaCO3	600 mg

Source: Hegsted et al. [13]

Table (3): The composition of vitamin mixture

Vitamin	Amount
Vitamin E	10 Iu
Vitamin K	0.50 Iu
Vitamin A	200 Iu
Thiamin	0.50 mg
Pyridoxine	1.00 mg
Niacin	4.00 mg
Calcium pantothenic acid	0.40 mg
Vitamin D	100 Iu
Choline chloride	200 mg
Folic acid	0.02 mg
Inositol	24 mg
Para-amino – benzoic acid	0.02 mg
Vitamin B12	2.00 µg
Biotin	0.02 mg

Source: Campbell, [14]

Experimental Design:

The study included all normal (6 rats) and diabetic (24 rats) rats. In addition to the experimental procedure, all rats involved in this investigation were fed the standard diet. The proposed interventions were orally administered once per day. The

weights of the rats were also recorded, and diabetic rats have divided into experimental groups accordingly. The following were the experimental groups:

Group 1: The non-diabetic group (control negative) consisted of six normal rats that received basal diet only.

2- Group 2: The diabetic control group (control positive) consisted of six diabetic rats that received basal diet only

3- Group 3: 10% juniper plants diabetic group (6 rats) were fed on basal diet containing 10% juniper plants

4- Group 4: 20% juniper plants diabetic group (6 rats) were fed on basal diet containing 20% juniper plants

5- Group 5: 25% juniper plants diabetic group (6 rats) were fed on basal diet containing 25% juniper plants.

METHODS

Induction of Diabetes (T1DM):

After two weeks of acclimatization of rats, type 1 diabetes mellitus was induced by intraperitoneal injections of alloxan 150 mg/kg body weight according to the method described by Desai and Bhide [15]. Following this, all rats fasted for 8 hours, and then blood samples were taken from the retro-orbital veins to determine blood glucose concentrations. The study included diabetic rats with blood glucose concentrations more than 185 mg/dL [16]. Following the exclusion of rats with blood glucose concentrations below 185 mg/dL and deceased rats, 24 rats were included in the study and subsequently developed diabetes. In addition, diabetic rats were given 2 IU of human insulin (Glargine, Lantus)

subcutaneously every week to keep them alive throughout the trial. To avoid spontaneous diabetes, blood glucose concentrations were also measured in the normal group.

HPLC identification of phenolic compounds:

Phenolic compounds fractions were extracted according to the method outlined by Hammouda et al. [17]. A known weight of dried powdered sample was soaked in 25 ml sterilized water and agitated on a rotary shaker for 24 h at 200 rpm. Solution was filtered through Whitman 0.34 mm filter paper under vacuum, followed by centrifugation at 12,500 g for 30 min at 80°C. The aqueous extract was acidified to pH 2.5 using diluted phosphoric acid. Each sample was partitioned three times with an equal volume of diethy1-ether. The combined diethy1- ether layer was evaporated to dryness under reduced pressure at 30°C. The resulting residue was redissolved in 3 ml of spectral grade methanol and filtered through a 0.2 mm filter sterilized membrane prior to HPLC analysis. Identification of individual phenolic compounds of the plant samples was performed on a Hewlett-Packard HPLC (Model 1100), using a hypersil C18 reversed-phase column (250 x 4.6 mm) with 5 mm particle size in.Injection by means of a Rheodyne injection valve (Model 7125) with 50 ml fixed loop was

used. A constant flow rate of 1 ml min-1 was followed with two mobile phases: (A) 0.5 % acetic acid in distilled water at pH 2.65, and solvent (B) 0.5 % acetic acid in 99.5% acetonitrile. The elution gradient was linear starting with (A) and ending with (B) over 35 min, using an UV detector set at wavelength 254 nm. Phenolic compounds of each sample were identified by comparing their relative retention times with those of the standards mixture chromatogram. The concentration of an individual compound was calculated on the basis of peak area measurements, then converted to mg phenolic g-1 dry weight. HPLC identification of phenolic compounds been in Cairo university, Faculty of agriculture, El-Gammaa St, Giza, Egypt.

Chemical composition

The chemical composition was performed on raw materials according to the A.O.A.C. [18]. The contents of moisture, protein, fat, crude fiber and ash of Lemongrass, Cratagaeus leaves and fruits were determined. Total carbohydrates were calculated by difference.

Biological evaluation

Throughout 28-day experimental duration, daily feed consumption & weekly Body wight gain (BWT) measurements were documented. F.E.R and body weight gain percent, were ascertained in accordance by Chapman et al. [19]. According to the following formula:

$$BWG\% = \frac{Final\ weight - Initial\ weight}{Initial\ weight} \times 100$$

$$FER = \frac{Gain\ in\ body\ weight\ (g/day)}{Food\ Intake\ (g/day)}$$

Blood Sampling and Laboratory Analysis:

After completing the intervention period spanning 28 days, blood samples were obtained from all rat groups following an 8-hour fasting period. The rats were euthanized under the influence of ether anesthesia. The hepatic portal vein was utilized to obtain blood samples, which were subsequently collected into tubes and subjected to immediate centrifugation at 3000 rpm for 10 minutes to facilitate serum separation. The serum was subjected to a precise aspiration process, followed by transfer into uncontaminated tubes, and subsequently preserved in a frozen state at a temperature of -20 oC, in preparation for analysis. Except for glucose, which was promptly assessed in serum [20], all serum specimens were utilized for determination of the following parameters

Triglyceride enzymatic calorimetric analysis was performed in accordance with Fassati &Prencipe [21].

Total cholesterol (TC) were determined according to Allain, [22].

HDL-cholesterol was determined according to Lopez, [23].

LDL & VLDL- cholesterol were calculated to Lee and Nieman [24] as the following equations: VLDL-c (mg / dl) = triglycerdes / 5, LDL-c (mg / dl) = total cholesterol – (HDL-c + VLDL-c).

Total Lipids (TL):The colorimetric technique was utilized to ascertain the

total lipids, as described by Lee & Nieman 1996 [24].

Alanine aminotransferase (ALT) was conducted in accordance with the methodology outlined by Tietz [25].

Determination of aspartate aminotransferase (AST) was performed In accordance with the technique of Henry, [26].

Total protein was determined In accordance with colorimetric technique of Henry, [26].

Creatinine (Cr) was measured In accordance with kinetic technique of Henry [26].

Urea was measured In accordance with enzymatic technique of Patton and Crouch, [27].

Uric acid was measured In accordance with technique defined by [20, 27, 28].

Statistical Analysis:

The obtained data underwent statistical analysis and were presented in terms of the mean and standard deviation (±SD). The present study employed the statistical techniques of analysis of variance (ANOVA) and least significant differences (LSD) to specify the degree of significance differences between various groups, with a confidence interval of 95% [29].

Results and Discussion

The aim of this investigation was to know ability of biologically active substances contained in juniper plants to improve blood sugar in hyperglycemia rats.

Data presents in Table (1) revealed The phenolic compounds (ppm) of dried juniper plant. It is evident that a total number of 18 distinct phenolic compounds were assessed in dried juniper plant, 16 of them existed, while the 2 absent compounds were: Syringic and Caffeine. Total phenolic compounds reached as high as (2609.91 ppm). It states that the highest total phenolic content was in direct relation with the Pyrogallol and Ellagic content and was in reversed relation with Catechin and Cinnamic. By Focusing on the major phenolic compound, it was found that the highest content was recorded for Pyrogallol (43.15% of total), followed by ellagic (20.04 % of total), Epicatechin (12.71 % of total) and .Benzoic (7.88 % of total). With benzoic acid, the 4 phenolic compounds constituted about 90% (88.92 %) of total. It is not expected that the best result for liver function parameters, for instance, will be in line with the highest total phenolic compounds in dried juniper plant (Pyrogallol & Ellagic), since possibly other affecting antioxidant compounds as vitamins C, A & E as well as the total antioxidation level was not determined.

Data of table (5) indicate average value of body weight gain (g/day/rat) of hyperglycemia rodents nourished on juniper plants 10%,20% and 25%. It might be detected that an average value of BWG percentage of control (-) was higher than control (+) group, being 1.75 ± 0.001 & 1.58 ± 0.008 respectively, presenting a

significant variance, with percentage of rise 10.75. The values were (1.7 ± 0.005, 1.66 ± 0.006 and 1.6 ± 0.009) for juniper plants 10%,20% and 25%, respectively. The percent of increase were (7.5, 5.06 and 1.26) for groups three, four & five, respectively. Numerically, the best body weight gain was noted for group three (hyperglycemia rodents nourished on juniper plants 10%). This outcome is consistent with outcomes of Singh et al. (2016), who also observed rams declined BWT.

Table (4): The phenolic compounds (ppm) of dried juniper plant (PPm).

N.	Test items	Dried juniper plant (ppm)
1	Syrringic	—
2	Pyrogallol	1126.29
3	Gallic	12.32
4	Protocatechuis	34.61
5	Catechol	69.25
6	4-Aminobenzoic	15.29
7	Catechein	10.34
8	Chlorogenic	49.85
9	P.oH.Benzoic	205.58
10	Epicatechen	331.69
11	Caffeic	22.62
12	Vanillic	28.67
13	Caffeine	—
14	Ferulic	28.93
15	Benzoic	134.06
16	Ellagic	522.90
17	Coumarin	10.57
18	Cinnamic	6.94
Total		2609.91

For FI data in table (5) demonstrated that an average value of FI % of control (-) was greater than control (+) group, being 14.28 ± 0.009 & 14.03 ± 0.001, respectively, stating a significant differences, with percentage of rise 1.78 . All hyperglycemia rats fed on juniper plants 10%,20% and 25%, showed significantly differences when in contrast to control (+) group. Values were 14.24 ± 0.005, 14.21 ± 0.002 & 14.15 ± 0.008 g/day/rat for juniper plants 10%,20% and 25% respectively. The percentage rise were (1.49, 1.28 and 0.85) for groups three, four & five, respectively. Statistically, the best FI was noted for group three (hyperglycemia rodents nourished on rams powder five percent.

As well as FER data of table (5) and revealed that an average value of FER percent of control (-) was greater than control (+) group , being 0.122 ± 0.0005 & 0.112± 0.0001, respectively , presenting significant differences, with percentage of rise 8.92. The values were (0.119 ± 0.0006, 0.116 ± 0.0009 and 0.113 ± 0.0007) for juniper plants 10%,20% and 25% , respectively . The percentage rise were (6.25, 3.57 & 0.89)for groups three , four & five respectively. Statistically, the better (FER) was noted for group 3 (hyperglycemia rodents nourished on juniper plants 10%).

Data of table (6) a showed average value of glucose in serum (mg/dl) of hyperglycemia rodents nourished on juniper plants 10%,20% and 25%. It was noted that an average value of serum glucose of control (-) was lesser than control (+) group, being 71.2 ± 0.9 & 330 ± 1 (mg/dl) , respectively , stating significant differences, with percentage of reduction – 78.42. All hyperglycemia rats

fed on juniper plants 10%,20% and 25% showed significantly variances when in contrast to control (+) group. Values were 298.4 ± 1.2, 277.7 ±1.15 and 274 ± 1 (mg/dl) for juniper plants 10%,20% and 25%, respectively. The percentage of decreases were (-9.5 , -15.84 & -16.96) for groups three , four & five, respectively . Statistically , the best glucose in serum was noted for group five (hyperglycemic rodents nourished on juniper 25%).

Table (5): Impact of distinct levels of juniper plant on body weight gain, FI & FER of hyperglycemia rodents.

Variable / Groups	BWG g/day Mean±SD	%Change of C+	F.I (g/day/rat) Mean+ SD	%Change of C+	F.E.R Mean±SD	%Change of C+
(Gl) Negative control	1.75a ± 0.001	10.75	14.28a ± 0.009	1.78	0.122a±0.0005	8.92
(G2) Positive control	1.58d ± 0.008	-	14.03d ± 0.001	-	0.112 ± 0.0001	
(G3) juniper 10%	1.7b ± 0.005	--	4.24b ± 0.005	1.49	b0.119 b±0.0006	6.25
(G4) juniper 20%	1.66c± 0.006	5.06	14.21b ± 0.002	1.28	0.116b ±0.0009	3.57
(G5) juniper 25%	1.6 e ± 0.009	1.26	14.15c ± 0.008	1.31	0.113 a ±0.0007	0.89
LS.D (<0.05)	0.011		0.011		0.001	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05 where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e) .

This finding is agreed with investigation did by Akkol et al. [30], which demonstrated that J. communis exhibited antidiabetic & antihyperlipidemia properties in diabetic rodents induced with streptozotocin (STZ) & nicotinamide. Except for group that administration glibenclamide (ten mg/kg).Diabetic rodents exhibited a notable decrease in levels of blood glucose & rise in HDL levels in response to methanolic extract of J. communis.

For T.C table (7) revealed that average value of serum TC of control (-) was lesser than control (+) group , being 110± land 130.3 ± 0.8 (mg/dl) , respectively , revealing significant differences, with percentage of reduction 15.57. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly variances when in contrast to control (+) group . values were (125.4 ± 0.6, 122.6 ± 1.15 and 120± 1) for juniper plants 10%,20% and 25%, respectively. The percentage of reductions were (-3.76 , -5.90 and -7.90) for groups three , four & five, respectively . superior serum TC was noted for group five (hyperglycemia rodents nourished on juniper plants 25%).

Table (6): impact of distinct levels of juniper plant on glucose (g)of hyperglycemic rats:

Variable / Groups	Glucose (mg/dl)	%Change of Control Positive	LSD (P< 0.05)
Groups	Mean±S D		
(Gl)Negative control (c-)	71.2a ±0.9	-78.42	
(G2)Positive control (c+)	330d ±1	-	
(G3)juniper 10%	298.4 c±1.2	-9.58	
(G4)juniper 20%	277.7b ±1.15	-15.84	0.231
(G5)juniper 25%	274b ±1	-16.96	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e)

As for, T.G table (7) showed that an average value of serum TG of control (-) was lesser than control (+) group , being 94 ± 1 & 98.2 ± 0.9 (mg/dl) .respectively , revealing significant variances, with percentage of reduction -4.27.The mean values of group 3,4 and 5 were 96.8 ± 0.2, 94.5 ± 1.2 and 92.7 ± 1 (mg/dl). The best serum TG was noted in group five (hyperglycemia rodents nourished on juniper plants 25%).

Data in table (7) reveal an average value of serum HDL (mg/dl) of hyperglycemic rodents nourished on juniper plants 10%,20% and 25%. It could be noted that an average value of serum HDL of control (-) was greater than control (+) group, being 40± land 35 ± l(mg/dl), respectively, presenting a significant differences, with percentage of rise 14.28.The mean values were (36.7± 1.15, 39.5 ± 1.2 and 38.9± 0.1 (mg/dl) for juniper plants 10%,20% and 25%respectively . Groups four & five revealed nonsignificant variances among them. The percent of decreases were 4.85, 12.85 & 11.14 for groups three, four & five respectively. Better serum HDL was recorded for group four (hyperglycemic rodents nourished on juniper plants 20% a).

For LDL, table (7) revealed that an average value of serum LDL of control (-) was lesser than control (+) group, being 51.2± 0.9and 75.7±1.15 mg/dl Respectively , presenting significant differences, with percentage of reduction -32.36.The values were 69.4±1.2, 64.4 ±0.9 and 62.6±0.8 (mg/dl) for juniper plants 10%,20% and 25%, respectively .The percentage of reductions were -8.34, - 14.93 and -17.30 for groups three , four & five .respectively. The best serum LDL was noted for group five (juniper plant 25%).

As for as VLDLc , table (7) showed that an average value of serum VLDLc of control (-) was lesser than control (+) group , being 18.8±0.2and 19.6±0.2(mg/dl) , respectively, revealing significant variances, with percentage of reduction -4.08. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly differences when in contrast to control (+) group. Values were 19.3 ± 0.05, 18.8 ± 0.25 & 18.5 ± 0.2 (mg/dl) for juniper plants 10%,20% and 25%, respectively. The percentage of reductions were (-1.53, -4.08 and -5.61) for groups three, four & five, respectively. The better serum VLDLc was noted for group five (hyperglycemic rodents nourished on juniper plants 25%). This finding is consistent with that of Fierascuet al. [31] who demonstrated that experimental evidence suggests juniper possesses antifungal, antibacterial, antiviral, and antioxidant properties. Experimental models have also demonstrated anti-inflammatory, cytotoxic, hypoglycemic, & hypolipidemic impacts in current researches. Additionally, the incorporation of essential oil into preserved meat impeded lipid peroxidation as a result of its potent

antioxidant properties, thereby extending the product's shelf life & enhancing the quality of the meat product. Therefore, natural antioxidants, like juniper, have the potential to replace synthetic antioxidants in meat products, thereby enhancing their shelf life . Also, the outcomes agreed with Akdogan et al. [32] who showed that juniper has anti-hypercholesterolemic effects.

Table (7): impact of distinct levels of juniper plant on T.C. & T.G of hyperglycemic rats

Variable / Groups	T.C (mg/dl) Mean±5D	%Change Control Positive group	of LS.D (<0.05)	T.G (mg/dl) Mean+50	%Change Control Positive group	of LS.D (<0.05)
(Gl)Negative control (c-)	110 e± 1	15.57	0.40	94° ± 1	-4.27	0.72
(G2)Positive control (c+)	130.3a ± 0.8	-		98.2a± 0.9	-	
(G3)juniper 10%	125.4b ± 0.6	-3.76		b96.8 ±0.2	-1.42	
(G4)juniper 20%	122.6C± 1.15	-5.90		94.5° ± 1.2	-3.76	
(G5)juniper 25%	120d ± 1	-7.90		d92.7 ± 1	-5.60	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05 where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e)

Table (8) : impact of distinct levels of juniper plant on H.D.L.c, L.D.L.c & V.L.D.L.c of hyperglycemic rodents

Variable / Groups	HDL (mg/dl) Mean±SD	%Change of Control Positive group	LS.D (<0.05)	LDL (mg/dl) Mean±SD	%Change of Control Positive group	LS.D (<0.05)	VLDL (mg/dl) Mea±SD	%Change of Control Positive group	LS.D (<0.05)
(Gl)Negative control (c-)	40a± 1	14.28	1.60	51.2a±0.9	-32.36	0.32	18.8a±0.2	-4.08	0.147
(G2)Positive control (c+)	35b ± 1			75.7d±1.15			d19.6±0.2		
(G3)juniper 10%	36.7d ± 1.15	4.85		b69.4±1.2	-8.34		b19.3±0.05	-1.53	
(G4)juniper 20%	39.5a ± 1.2	12.85		c64.4±0.9	-14.93		18.8b±0.25	-4.0$	
(G5)juniper 25%	a38.9±0.1	11.14		62.6c±0.8	-17.30		a18.5±0.2	-5.61	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05 where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e)

Data of table (9) reveal average value of serum AST (u/1) of hyperglycemic rodents nourished on juniper plants 10%,20% and 25%. It could be noted that average value of serum AST of control (-) was lesser than control (+) group, being 56.2±0.9 & 64-1 u/1, revealing significant differences, with percentage of reduction -12.18. All hyperglycemia rats fed on juniper plants 10%,20% and 25% showed significantly variances when in contrast to control (+) group. Values were 62±1.00, 60 ± 1.00 and 58 ± 1.00 u/1 for juniper plants 10%,20% and 25% respectively. The percentage of reductions were (-3.12, -6.25 & -9.37) for groups three, four & five. The best serum AST was noted for group five (hyperglycemic rodents nourished on juniper plants 25%).

As for , ALT, data in table (9) investigated that an average value of serum ALT of control (-) was lesser than control (+) group , being 27±1 & 37±1 u/1, presenting significant differences, with percentage of decrease -27.02. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly variances when in contrast to control (+) group. Values were 35 ± 1.00, 35± 1.00 and 33 ± 1.00 for juniper plants 10%,20% and 25%, respectively. Group 3 & 4 revealed non-significant variances amongst them. Percentage of decreases were -5.40, -5.40 and -10.81 for groups three, four & five, respectively. Statistically, the best serum ALT was noted for group five (hyperglycemia rodents nourished on juniper plants 25%). This result agrees with Manvi and Garg, [33] who found that hepatoprotective activity of J. communis in rodents was assessed by administering CCl4 over a period of nine days. The serum concentrations of SGOT, SGPT, TB, & ALP increased significantly in the CCl4 treatment group relative to control group. In silymarin-treated group, SGPT, SGOT, TB, & ALP concentrations decreased significantly. The observed elevated concentrations of bilirubin, SGOT, SGPT, & ALP were the result of CCl4-induced hepatotoxicity.

Table (9): Effect of different levels of juniper plant on liver function for hyperglycemic rats:

Variable / Groups	AST (U/L) Mean+SD	% Change of Control Positive group	L.S.D (<0.05)	ALT (U/L) Mean±SD	% Change of Control Positive group	L.S.D (<0.05)
(Gl)Negative control (c-)	56.2e ± 0.9	-12.18	0.084	27c ± 1	-27.02	1.819
(G2)Positive control (c+)	64a ±1.00	-		37a ± 1	-	
(G3)juniper 10%	62b ± 1.00	-3.12		35ab ± 1	-5.41	
(G4)juniper 20%	60c ± 1.00	-6.25		35ab ± 1	-5.41	
(G5)juniper 25%	58d ± 1.00	-9.37		33b ± 1	-10.81	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05 where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e)

Data of table (10) showed the mean value of serum Urea (mg/dl) of hyperglycemia rodents nourished on juniper plants ten percent, twenty percent & twenty five percent . It could be detected that an average value of serum Urea of control (-) was lesser than control (+) group, being 17±1.00 & 27±1.00 mg/dl, presenting significant differences, with percentage of reduction -37.03. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly reductions when in contrast to control (+) group. Values were 25± 1.00, 24± 1.00 and 22 ± 1.00 mg/dl for juniper plants 10%,20% and 25% respectively .Group 3 & 4 revealed non-significant variances among them . percentage of decreases were -7.40, -11.11 and -18.51 for groups three , four & five, respectively. The superior serum Urea was noted for group five

(hyperglycemic rodents nourished on juniper plants 25%).

For U.A, (mg/dl) data of table (10) indicated that control (-) was lesser than control (+) group, being 1.9 ± 0.1 & 3.6 ± 0.1 respectively, presenting significant differences, with percentage of decrease -47.22. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly decreases when in contrast to control (+) group. Values were 3.2 ± 0.1, 2.7 ± 0.1 & 2.2 ± 0.1 for juniper plants 10%,20% and 25%, respectively. The percentage of reductions were -11.11, -25 & -38.88 for groups three, four & five. Statistically, the best serum U.A was noted for group five (hyperglycemia rodents nourished on juniper plants 25%).

As for reatinine ,Table (10) showed that control (-) was lesser than control (+) group , being 0.2 ± 0.1 & 0.6 ± 0.1, presenting significant differences, with percentage of reduction -66.6. All hyperglycemic rats fed on juniper plants 10%,20% and 25% showed significantly decreases when compared with control (+) group. Values were 0.5 ± 0.1, 0.4 ± 0.1 & 0.3 ± 0.1 for juniper plants 10%,20% and 25% respectively. Group three, four & five revealed non-significant variances amongst them . The percentage of reductions were -16.6, -33.3 & -50 for groups three, four & five, respectively . Superior serum Creatinine was noted for group five (hyperglycemic rodents nourished on juniper plants 25%) . In research by Hosseini et al., [34], the results of this investigation showed that high concentrations of juniper extract had the most significant effect on renal function of male Wistar rodents. Although urine volume & creatinine levels rised in intervention groups, serum urea levels also rose; this may be attributable to the extract's deleterious effects. Its impact on additional parameters of renal function is negligible.

Table (10): Effect of different levels of juniper plant on Kidney function (creatinine, urea & uric acid) for hyperglycemic rats.

Variable / Groups	Urea (mg/dl) Mean±SD	% Change of Control Positive group	LSD (<0.05)	U.A (Mg/dl) Mean±SD	% Change of Control Positive grou	LS.D (<0.05)	Creatinin (Mg/dl) Mean±SD	% Change of Control Positive group	LS.D (<0.05)
(Gl) Negative control (c-)	17d ±1	-37.03		1.9C±0.1	-47.22		0.2C±0.1	-66.6	
(G2)Positive control (c+)	27 a± 1	-	618′	3.6a±0.1	-	610.	0.6a±0.1	-	1.819
(G3)juniper 10%	25b ± 1	-7.40	—	3.2b ±0.1	-11.11		0.5b ±0.1	-16.6	
(G4)juniper 20%	24b ± 1	-11.1		2.7d±0.1	-25		0.4e±0.1	-33.3	
(G5)juniper 25%	22c ± 1	-18.51		2.2d ±0.1	-38.88		0.3 d± 0.1	-50	

Data are expressed as mean ± SD. Values within a column having different superscripts are significantly different (p ≤ ;(0.05 where the small letters indicate significant among dietary treatment groups as indicated by one-way ANOVA followed by (a > b > c > d > e)

Conclusion

Based on its historical applications in disease treatment & the abundance of active chemical constituents it contains that impart a variety of pharmacological & medicinal attributes, juniper is an essential medicinal plant, according to a comprehensive review of scientific literature. Additional investigations is needed to validate therapeutic properties of juniper & develop formulations incorporating this plant for clinical use that contributes to the betterment of humanity.

References

1. Arno SF. Northwest trees: Identifying and understanding the region's native trees. Mountaineers Books; 2020 Aug 12.
2. Yang Y, Ferguson DK, Liu B, Mao KS, Gao LM, Zhang SZ, Wan T, Rushforth K, Zhang ZX. Recent advances on phylogenomics of gymnosperms and a new classification. Plant diversity. 2022 Jul 1;44(4):340-50.
3. Zielińska D, Zieliński H, Laparra-Llopis JM, Szawara-Nowak D, Honke J, Giménez-Bastida JA. Caffeic acid modulates processes associated with intestinal inflammation. Nutrients. 2021 Feb 8;13(2):554..
4. Newman DJ, Cragg GM. Natural products as sources of new drugs over the nearly four decades from 01/1981 to 09/2019. Journal of natural products. 2020 Mar 12;83(3):770-803.
5. Saswata Banerjee SB, Hariom Singh HS, Chatterjee TK. Evaluation of anti-diabetic and anti-hyperlipidemic potential of methanolic extract of Juniperus communis (L.) in Streptozotocin-nicotinamide induced diabetic rats. Int. J. Pharma Bio Sci. 2013, 4, 10–17.
6. Zivic, N.; Milosevic, S.; Dekic, V.; Dekic, B.; Ristic, N.; Ristic, M.; Sretic, L. Phytochemical and antioxidant screening of some extracts of Juniperus communis L.and Juniperus oxycedrus L. Czech J. Food Sci. 2019, 37, 351–358.
7. Bento, C.; Gonçalves, A.C.; Silva, B.; Silva, L.R. Peach (Prunus Persica): Phytochemicals and health benefits. Food Rev. Int. 2020; Ahead-of-print.
8. Mediavilla, I.; Guillamón, E.; Ruiz, A.; Esteban, L.S. Essential oils from residual foliage of forest tree and shrub species: Yield and antioxidant capacity. Molecules 2021, 26, 3257.
9. Fatima, N.; Baqri, S.S.R.; Alsulimani, A.; Fagoonee, S.; Slama, P.; Kesari, K.K.; Roychoudhury, S.; Haque, S. Phytochemicals from Indian ethnomedicines: Promising prospects for the management of oxidative stress and cancer. Antioxidants 2021, 10, 1606.
10. Deepthi B, Sowjanya K, Lidiya B, Bhargavi RS, Babu PS. A modern review of diabetes mellitus: an annihilatory metabolic disorder. J In Silico In Vitro Pharmacol. 2017;3(1).

11. Ozougwu JC, Obimba KC, Belonwu CD, Unakalamba CB. The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus. J Physiol Pathophysiol. 2013 Sep 30;4(4):46-57.

12. Reeves PG, Nielson FH, Fahmy GC."Reports of the American Institute of Nutrition, adhoc wiling committee on reformulation of the AIN 93". Rodent Diet. J. Nutri. 1993, 123: 1939-1951.

13. Hegsted D, Mills R, Perkins E. Salt mixture. J. Biol. Chem. 1941, 138: 459.

14. Campbell JA. Methodology of Protein Evaluation. RAG Nutr., 1963, Document R.10, Led . 37. June Meeting, New York .

15. Desai A, Bhide M. Hypoglycemic effect of Hanitonia suavecolens. Idian. J. Med., 1985, 81: 86-91.

16. National Diabetes Data Group. Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes. 1979 Dec 1;28(12):1039-57.

17. Hammouda IB, Márquez-Ruiz G, Holgado F, Sonda A, Skalicka-Wozniak K, Bouaziz M. RP-UHPLC–DAD-QTOF-MS as a powerful tool of oleuropein and ligstroside characterization in olive-leaf extract and their contribution to the improved performance of refined olive-pomace oil during heating. Journal of Agricultural and Food Chemistry. 2020 Oct 15;68(43):12039-47.

18. A.O.A.C. Association of Official Analytical Chemists International. William, 17th ed., Gaithersbuy MD, USA, 2000.

19. Chapman DG, Castillo R, Campbell JA. Evaluation of protein in foods: 1. A method for the determination of protein efficiency ratios. Canadian Journal of Biochemistry and Physiology. 1959 May 1;37(5):679-86.

20. Trinder P. Glucose enzymatic colorimetric method. J. Clin. Biochem. 1969 (6):24.

21. Fassati P, Prencipe L. Triglyceride enzymatic colorimetric method. J. of Clin. Chem., 1982, 28: 2077.

22. Allain CC, Poon LS, Chan CS, Richmond WF, Fu PC. Enzymatic determination of total serum cholesterol. Clinical chemistry. 1974 Apr 1;20(4):470-5.

23. Lopez MF. HDL-cholesterol colorimetric method. J. of Clin. Chem, 1977, 23:882.

24. Lee RD, Nieman 2nd DC. Nutritional assessment 2nd. Ed. Mosby-Year Book. 1996.

25. Tietz NW. Fundamentals of clinical chemistry WB Saunders Co. Philadelphia PA. 1976;47.

26. Henry RJ. Clinical Chemist: Principles and Techniques, Hagerstoun (MD). 1974

27. Patton CJ, Crouch SR. Enzymatic determination of urea. Journal, of Anal. Chem., 1977, 49: 464-469.

28. Barham D, Trinder P. An improved colour reagent for the determination of blood glucose by the oxidase system. Analyst. 1972;97(1151):142-5.

29. Snedecor GW, Cochran WG. Statistical Methods. 6th EdIowa State Univ Press. Ame. Iowa. USA. 1967.

30. Akkol EK, Ilhan M, Karpuz B, Genç Y, Sobarzo-Sánchez E. Sedative and anxiolytic activities of Opuntia ficus indica (L.) Mill.: An experimental assessment in mice. Molecules. 2020 Apr 16;25(8):1844.

31. Fierascu I, Ungureanu C, Avramescu SM, Cimpeanu C, Georgescu MI, Fierascu RC, et al. Genoprotective, antioxidant, antifungal and anti-inflammatory evaluation of hydroalcoholic extract of wild-growing Juniperus communis L.(Cupressaceae) native to Romanian southern sub-Carpathian hills. BMC complementary and alternative medicine. 2018 Dec;18:1-4.

32. Akdogan M, Koyu A, Ciris M, Yildiz K. Anti-hypercholesterolemic activity of Juniperus communis Lynn oil in rats: A biochemical and histopathological investigation. Biomed. Res. 2012 Jul 1;23(3):321-8.

33. Garg GP. Screening and evaluation of pharmacognostic, phytochemical and hepatoprotective activity of J. communis L. stems. International Journal of Pharma and Bio Sciences. 2010;1(3).

34. Hosseinihashemi SK, Dadpour A, Lashgari A. Antioxidant activity and chemical composition of Juniperus excelsa ssp. Polycarpos wood extracts. Natural product research. 2017 Mar 19;31(6):681-5..

مجلة الاقتصاد المنزلي، جامعة المنوفية

https://mkas.journals.ekb.eg

الترقيم الدولي اون لاين 2735-590X

الترقيم الدولي للطباعة 2735-5934

التغذية وعلوم الأطعمة

دراسة الخواص المضادة لمرض السكري لنباتات العرعر في الفئران المصابة بالسكري.

لبنى سعد محمد ونادية سعيد الزهراني

قسم الاقتصاد المنزلي (تغذية)، كلية العلوم والآداب بالمخواه، جامعة الباحة، المخواه، المملكة العربية السعودية

نوع المقالة

بحوث اصلية

المؤلف المسئول

لبنى سعد

lobna@bu.edu.sa

الجوال 6320 302 53 966+

DOI:10.21608/mkas.2024.249892.1265

الاستشهاد الي:

Lobna Abd Elmeged, and Nadiah Alzahrani. (2024). Antidiabetic Potential of juniper plants in diabetic rats. JHE, 34 (2), 1-17

تاريخ الاستلام: ١٩ نوفمبر ٢٠٢٣

تاريخ القبول: ٨ يناير ٢٠٢٤

تاريخ النشر: ١ ابريل ٢٠٢٤

الملخص العربي:

العرعر هو نبات صنوبري مصنف ضمن عائلة السرو، وتقليديا تم استخدام العرعر لصفاته العلاجية، وتحديدا فى علاج أمراض صحية معينة، مثل مرض السكري. لذلك كان الهدف من هذا البحث هو فحص قدرة المواد الفعالة بيولوجيا الموجودة فى نباتات العرعر على تحسين نسبة السكر فى الدم لدى الفئران المصابة بارتفاع السكر فى الدم :.تم توزيع مجموعة من ثلاثين (30)من ذكور الفئران البيضاء من سلالة الالبينو، يزن كل منها 10±170جراما فى عمر عشرة أسابيع، فى أربع مجموعات متميزة .كانت المجموعة الأولى بمثابة عنصر تحكم سلبى)أي قياسى(، على الرغم من أن المجموعات الأخرى تعرضت لتحريض الوكسان لمرض السكري .فى فترة الدراسة التى استمرت 28يوما، تم تغذية ثلاثة فى مجموعة التحكم الإيجابية لمرض السكري بنباتات العرعر بتركيزات عشرة بالمائة وعشرين بالمائة وخمسة وعشرين بالمائة .تم إجراء التحليل الكيميائى الحيوي على الأعضاء المستأصلة وعينات الدم التى تم جمعها بعد التجربة .تم العثور على تباين كبير بين المجموعات فيما يتعلق بمستوى الجلوكوز P)يساوي (0.005قبل وبعد التدخل .تم تسجيل أفضل جلوكوز المصل، البروتينات الشحمية عالية الكثافة، الاسبارتات ترانزامينيز، والكرياتينين للمجموعة) 5فئران ارتفاع السكر فى الدم تتغذى على العرعر 25٪ .(أظهرت نتائج هذا البحث أن العرعر يحمل قيمة طبية كبيرة بسبب تطبيقاته التاريخية فى علاج الأمراض ووفرة المكونات الكيميائية النشطة التى تضفى مجموعة من السمات الدوائية والطبية.

الكلمات الكاشفة: الأعشاب، المركبات الفينولية ، الجلوكوز ، ارتفاع السكر في الدم ، النظام الغذائي ، الدهون